

**FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT**



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Idaho Operations Office

2008 Advanced Fuel Cycle Research and Development

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TABLE OF CONTENTS

PART I – FUNDING OPPORTUNITY DESCRIPTION	3
A. STATEMENT OF OBJECTIVES.....	3
PART II – AWARD INFORMATION	7
A. TYPE OF AWARD INSTRUMENT	7
B. ESTIMATED FUNDING	7
C. MAXIMUM AND MINIMUM AWARD SIZE	7
D. EXPECTED NUMBER OF AWARDS	8
E. ANTICIPATED AWARD SIZE	8
F. PERIOD OF PERFORMANCE	8
PART III - ELIGIBILITY INFORMATION	8
A. ELIGIBLE APPLICANTS.....	8
B. COST SHARING.....	8
PART IV – APPLICATION AND SUBMISSION INFORMATION	10
A. ADDRESS TO REQUEST APPLICATION PACKAGE	10
B. LETTER OF INTENT AND PRE-APPLICATION	10
C. CONTENT AND FORM OF APPLICATION – 424 (R&R).....	11
D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS	15
E. SUBMISSION DATES AND TIMES.....	15
F. INTERGOVERNMENTAL REVIEW.....	15
G. FUNDING RESTRICTIONS	15
H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS	16
PART V - APPLICATION REVIEW INFORMATION.....	17
A. CRITERIA	17
B. REVIEW AND SELECTION PROCESS	18
C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES.....	18
PART VI - AWARD ADMINISTRATION INFORMATION	18
A. AWARD NOTICES.....	18
B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS	19
C. REPORTING	19
PART VII - QUESTIONS/AGENCY CONTACTS	19
A. QUESTIONS	19
B. AGENCY CONTACT	19
PART VIII - OTHER INFORMATION.....	19
A. MODIFICATIONS	19
B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE	20
C. COMMITMENT OF PUBLIC FUNDS	20
D. PROPRIETARY APPLICATION INFORMATION	20
E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL.....	20
F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM.....	20
G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER	21
ATTACHMENTS.....	21
A. REPORTING REQUIREMENTS CHECKLIST	21
B. AWARDEE POINT OF CONTACT DATA INPUT SHEET	21

PART I – FUNDING OPPORTUNITY DESCRIPTION

A. STATEMENT OF OBJECTIVES

ADVANCED FUEL CYCLE R&D PROGRAM

Background

The Advanced Fuel Cycle Initiative (AFCI) is focused on research, development and demonstration activities that support the safe, secure expansion of nuclear power. Internationally, GNEP is working to establish a framework to ensure that nuclear power expansion can be achieved in conjunction with reduced risk of nuclear weapons proliferation. Domestically, GNEP, through the AFCI, seeks to evaluate the advanced technologies and facilities needed to recycle used nuclear fuel. If deployed, this approach would allow the United States to separate used fuel into waste and usable components, enable reactors to extract additional energy, and provide options for more effective management of the residual waste. More detailed information on GNEP and the AFCI can be obtained from the web pages, <http://www.gnep.energy.gov>, <http://www.nuclear.energy.gov/AFCI/neAFCI.html>, and <http://www.nuclear.energy.gov> which include the GNEP strategic plan and fact sheets as well as links to the Administration's FY 2008 and FY 2009 AFCI budget submissions to Congress.

Advanced Fuel Cycle Research and Development Program

The DOE is seeking applicants from industry, universities, and national laboratories to conduct research and development (R&D) in support of the AFCI/GNEP advanced fuel cycle objectives. Applicants may submit multiple applications. Applications are sought in any or all of the following program elements:

1. Used Fuel Separations Technology
2. Advanced Nuclear Fuel Development
3. Fast Burner Reactors and Advanced Transmutation Systems
4. Advanced Fuel Cycle Systems Analysis
5. Advanced Computing and Simulation
6. Safeguards
7. Advanced Waste Forms

Details on each of the above areas follow:

- 1. Used Fuel Separations Technology:** AFCI activities focus on reducing the volume and radiotoxicity of high-level waste from used nuclear fuel, reducing the long-term proliferation risk posed by civilian inventories of plutonium and providing technologies for the recovery of the energy content of used nuclear fuel. Currently, technologies under investigation include advanced recycling technologies, both aqueous and electrochemical, to extract transuranic elements for transmutation in power-producing reactors. Thus the quantities of material requiring disposal in a repository could be reduced. Among the volatile fission and activation products released by recycling used fuel, collection and preparation of stable waste forms is an important objective. Non-volatile fission products need to be isolated in a form suitable for waste disposal. Some portion of the used fuel cladding may be used for waste form preparation and the remainder decontaminated for disposal although technologies for recycle of cladding and end pieces may be developed. Recovered transuranics must be prepared in a form suitable for recycled fuel or target development. Advanced instrumentation for accountability also needs to be developed in conjunction with advanced recycling technologies. Concepts for the reuse, recycle, and management of separated uranium are of interest. Examples of relevant research and development topics are: the collection and separation of the rare gases, krypton and xenon; the separation of americium from curium; the development of a solvent extraction process for actinide fractionation using no more than two different solvents; the

development of a continuous, countercurrent electrochemical process; the application of electromagnetic separations, from broad separation of heavy from light elements to the more precise separation of isotopes by mass; and the development of a computer simulation code for a complete separations plant.

2. **Advanced Nuclear Fuel Development:** This program element focuses on conducting research and development activities to develop advanced fuels, or targets, leading to qualification for use in commercial fast and thermal spectrum transmutation systems. The fuel forms of interest include fertile (high uranium content), low-fertile (low uranium content) and non-fertile (no uranium content) compositions in ceramic, metal, oxide, and composite fuels and targets. The general research and development topics of interest cover wide-ranging areas of fuel modeling, fuel and target fabrication process development, characterization methods, in-pile and out-of-pile testing, advanced instrumentation for in-pile testing, advanced fuel matrix, and cladding material development.

Fuel design and analyses for advanced reactor concepts will require the definition and analysis of the fuel forms needed for transmutation. Fuel performance will require the design of phenomenological experiments aimed at fundamental understanding of fuel performance. Fuel safety envelope assessments will assess the safety envelopes of advanced fuel systems by analytical means. Assessment of surrogate materials will be necessary to determine appropriate surrogate materials for addressing different fuels phenomenology as an early way to avoid using expensive and time-consuming real materials. Fabrication process development will devise low-temperature, or low-heat, fuel fabrication processes, specifically for Am-bearing fuels; remote fabrication and quality assurance processes for fuels containing high quantities of TRU; fuel fabrication processes; and benchmark the modeling processes against known data. Advanced mechanistic models and simulation tools will be required to develop atomistic-scale to continuum-scale models to replace the empirical modules in existing performance codes. In-core materials development is necessary to develop advanced materials for use in GNEP reactor concepts with enhanced corrosion resistance and improved resistance to radiation damage (e.g., embrittlement). Additionally, the ability to model the effects of irradiation in a high-energy proton and neutron spectrum (spallation and fast reactor conditions) on the mechanical properties of ferritic/martensitic steels at prototypic temperatures from 400-600 °C is desired.

3. **Fast Burner Reactors and Advanced Transmutation Systems:** Transmutation is a process by which long-lived radioactive species, particularly actinides (but also certain fission products), are converted into short-lived nuclides by either fission or neutron capture and decay. By reducing the time for decay from millennia to hundreds of years, toxicity and heat load challenges associated with disposal of used nuclear fuel fall into the realm of well-known engineering practices, and thus become easier to solve with better certainty of success. Since fast reactors are very effective for transmutation of transuranics, the current focus of work in this area is on fast reactors, specifically on the sodium cooled fast reactor. However, the program envisions R&D to include other transmutation systems which may be used alone or in combination with fast reactors to address long-lived radioactive species of used nuclear fuel.

A critical component of a viable closed fuel cycle is that it needs to be economic to be successful. To become economical, uncertainty on the physics of transmutation systems needs to be better understood so that costly unwarranted design margins can be eliminated. Improved structural materials that perform better and longer in extreme radiation environments are necessary. Critical components need research to reduce costs and increase reliability.

The reactor component of the R&D program targets the development and demonstration of advanced reactor technology that can be commercially deployed to efficiently and safely consume transuranic elements recovered from used fuel in a closed fuel cycle. The research focus is on fast reactor systems which are eventually required for repeated recycle. Some key technology needs are capital cost reduction, reactor safety validation, and establishment of domestic infrastructure.

The viability of the sodium fast reactor technology is well established; however, the U.S. infrastructure for this technology is severely eroded. Therefore, this area of R&D also needs to support re-establishment of domestic infrastructure to support sodium-cooled fast reactor technology. Examples of R&D areas relevant to the program needs include, but are not limited to, capital cost reduction through system design optimization and use of innovative technologies including advanced materials, advanced neutronics, thermal-hydraulic and structural modeling, and enhancements to U.S. infrastructure for fast reactor technology.

4. **Advanced Fuel Cycle Systems Analysis:** The systems analysis area involves evaluating the performance of the nuclear fuel cycle as an integrated system against a set of metrics. Various areas for analysis include nuclear power generation and supporting fuel cycle facilities and their relationships to one another in terms of functions and requirements, material flows, transportation, costs, and other interdependencies.

Applications are being sought for the systems analysis of advanced fuel cycles that take advantage of technologies at the conceptual or low technology readiness levels and have the potential for significant benefits later, which could justify investments in R&D. As part of the application, one or more initial future fuel cycle concepts proposed for analysis will be described, along with the rationale as to why these particular concepts warrant funding for further definition and more detailed systems analysis. Fuel cycle concepts proposed for analysis will hold promise for providing high performance with respect to the following set of attributes when evaluated from an integrated systems perspective over facility lifecycles: (1) **safety** (may be assessed later at a high level with an integrated risk assessment); (2) **security** (against theft, diversion, and sabotage); (3) **waste management** including low-waste production, particularly for wastes that are difficult to dispose of (this may be accomplished, for example, through innovative technologies, and/or markets for products); (4) **economics**; (5) **sustainability** (system must provide at least one pathway towards long-term sustainability); and (6) **affordability** (are the benefits of the futuristic fuel cycle sufficient to justify long-term U.S. Government investment and under what conditions?). Detailed metrics for assessing the above attributes will be defined as part of the work effort, examples of which may be included in applications for this work.

Additionally, the set of initial fuel cycle concepts/architectures proposed for analysis will be generally defined in terms of types of fuel cycle technologies and facilities, identifying the main functions/relationships between important elements, and which, if any, might be co-located. The statement of objectives will allow flexibility for further definition and refinement of proposed architectures. Fuel cycle concepts/architectures may make use of more mature technologies in conjunction with the use of advanced concepts/technologies (i.e., the entire fuel cycle need not be based entirely upon the use of advanced technologies). However, the objective of this particular research and analysis effort is directed towards more advanced fuel cycles holding potential future promise in the long-run that may serve to guide R&D investments. Proposed work will be focused on identifying and analyzing primary areas of uncertainty that could have a potential significant bearing on overall fuel cycle performance.

5. **Advanced Computing and Simulation:** The GNEP modeling and simulation program is currently creating strategies and plans to build new levels of capabilities required to support the development, deployment and operation of the nuclear energy systems needed to achieve the GNEP vision. On a very high level, these capabilities will include the development of:

- Integrated Performance and Safety Codes (IPCS) for:
 - Recycling Reactors;
 - Separation and Safeguard Systems; and

- Waste Forms and Disposal Facilities;
- Physics and Material Models (PMM) needed to support the Integrated Codes;
- Verification, Validation, and Quantification of Margins and Uncertainties (VVQ) methodologies and implementations;
- Capability Transfer (CT) to move codes out of the research laboratory environment and into the hands of industrial users including making the codes and the HPC environments easier to use; and
- Enabling Computational Technologies (ECT) needed to make the above items possible.

AFCI/GNEP has work underway with the national laboratories in many of the above areas and seeks to continue that work as well as extending the work to universities and industry. Therefore, we are seeking applications for any of the five areas listed above. However, due to the limited funding and time scale of the financial assistance, we are particularly interested in applications for the areas of PMM and ECT.

In the area of PMM, we would be interested in applications to develop the lower length scale models (both molecular dynamics and displacement dynamics) that would allow the understanding of relevant material properties in hostile environments (e.g., high temperature, high radiation). This understanding could then be implemented as higher level models in the Integrated Performance and Safety Codes.

In the area of ECT, we would be interested in proposals to advance relevant underlying computational techniques that would allow the efficient programming of modern advanced computers to support GNEP applications. This could include the development of new framework technologies that would allow for the efficient integration of application modules. This could also include the development of libraries that would assist in programming the new, often heterogeneous computer architectures that GNEP will be required to use.

While only two of the five modeling and simulation program elements are specifically mentioned, that is not meant to preclude innovative ideas for the other three. It does, however, reflect the priorities of the program for this financial assistance and level of funding and expected period of performance for the work to be completed.

- 6. Safeguards:** Advancing safeguards and strengthening the nonproliferation regime are an integral part of the GNEP nonproliferation vision, implemented through a systematic framework of governance and deployment of advanced technologies. The primary objective of R&D in the safeguards area is to provide technologies that allow a new generation of safeguards performance to be realized so that facilities built under GNEP may fully meet all regulatory and licensing requirements. The research and technology development needs of GNEP fall into three broad categories:

- Advanced instrumentation – On-line and at-line, near-real time monitoring methods based on radiation and non-radiation signatures operated in active and passive mode and encompassing destructive and nondestructive analysis are needed. Process monitoring will be incorporated in a quantitative manner, and include tracking both hot (Pu and other radioactive species) and cold (non-radioactive) streams. There are nuclear and chemical data needs that support improving advanced instrumentation, evaluation of existing data and developing new data to enable new techniques. Modeling and simulation tools to support sensor design are needed. Opportunities exist in new materials by design and in materials evaluation in high radiation environments.

- Safeguards by Design – Incorporating design features that facilitate safeguards and physical security requirements into the design of new facilities at the earliest possible stage is one of the best opportunities to maximize the efficacy of the safeguards system and minimize the cost and impact to the operator. Models of safeguards performance play a key role to inform decision makers regarding investment of R&D funds as well as to identify advanced approaches. Analysis of the safeguards system needs to occur at adequate levels, including facility, site, region, and global. Implementation of safeguards by design relies on both experimental and theoretical development along with lab-scale and large-scale experimental demonstration.
- Advanced control and integration – The accuracy and precision required to meet both domestic and International Atomic Energy Agency (IAEA) goals using a single measurement technique are impractical with today's technology, and as such modern facility safeguards employ a variety of tailored instruments in optimized configurations along with additional measures such as containment and surveillance, tags and seals, and integrated safeguards. In addition to developing advanced instrumentation, technology also must involve development of an integrated control system that uses all available instruments and other information through an intelligent data analyzer. The development of the advanced control system relies heavily on plant modeling and simulation, basic information management including data security, and it requires an engineering-scale facility for demonstration and optimization.

Modeling and simulation cross cuts all three of the broad categories and plays an important role in sensor and advanced instrumentation development, design of the overall safeguards system for a facility, and analysis of components within the safeguards system, as well as the nonproliferation regime. Implementation of the advanced control system described will require plant modeling and simulation.

7. **Advanced Waste Forms:** This program element is primarily focused on the development and demonstration of optimized, durable waste and storage forms for disposition. Even a closed fuel cycle requires a geologic repository to store and/or dispose of short-lived and long-lived fission products and trace actinides, the latter being from separations process losses. Potential waste form materials (e.g., oxides, glasses, and/or metals) containing the radionuclides are a key component of the repository system. The potentially significant doses from the encased radionuclides require long-term isolation in durable waste forms and/or storage forms. Additional research and development is required to identify candidate waste form materials and optimize their production. Once candidate waste form materials are further developed, focused work to further understand waste form performance in a variety of complex geologic settings is needed. Developing the understanding of waste form performance will require both experimental and modeling and simulation research activities. Proposed projects may involve R&D in any of the above areas.

PART II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

- DOE will award grants, cooperative agreements, or field work authorizations under this program announcement. A DOE field work authorization will be awarded to a successful DOE National Laboratory; a grant or cooperative agreement will be awarded to any other successful entity including, but not limited to, universities, non-profits and for-profit organizations.

B. ESTIMATED FUNDING

- Total of approximately \$15 million is expected to be available for new awards in FY 2008.

C. MAXIMUM AND MINIMUM AWARD SIZE

- Ceiling (i.e., the maximum amount for an individual award made under this announcement): \$2 million. (See Section II.E. below for more detail and exceptions).
- Floor (i.e., the minimum amount for an individual award made under this announcement): \$ None specified.

D. EXPECTED NUMBER OF AWARDS

- DOE anticipates making 20 – 30 awards under this announcement depending on the size of the awards.

E. ANTICIPATED AWARD SIZE

- While the maximum award size (i.e., the ceiling) is anticipated to be \$2 million, DOE anticipates that awards will be in the \$250,000 to \$2 million range. If requested levels of funding exceed \$2 million, applicants must justify need for more funds.

F. PERIOD OF PERFORMANCE

- DOE anticipates making awards that will run for up to 1 year. Work must be completed according to the terms and conditions of the award.

TYPE OF APPLICATION

- DOE will accept only new applications under this announcement. A separate application must be submitted for each program element under Part I, for which the applicant is interested in receiving an award. The criteria of Part II will apply to each application separately. There is no limitation on the number of applications that an applicant may submit. Each application must be complete and may not rely upon another application for submission of the required documents. The same project should not be submitted, and will not be evaluated, under more than one program element. If it is determined during the initial review that a project should be considered under a different program element, the application will be forwarded for review under that area.

PART III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

- All types of entities are eligible to apply, except organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995. However, the lead applicant must be a United States company, university, or National laboratory.

B. COST SHARING

- In accordance with Section 988 of the Energy Policy Act of 2005, the cost share requirement has been waived. However, cost share is encouraged and may be a consideration in selecting applications for award.

C. Other Eligibility Requirements

- **DOE National Laboratory Contractors**

A National Laboratory Contractor is eligible to apply for funding under this announcement as an applicant and may perform all or a portion of the work in the Statement of Objectives if its cognizant contracting officer provides written authorization and this authorization is submitted with the application.

Authorization If a DOE National Laboratory Contractor is selected for award, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory's M&O contract. The following wording is acceptable for the authorization by the cognizant contracting officer allowing the National Laboratory Contractor to participate in the project:

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complimentary to the missions of the laboratory and will not adversely impact execution of the DOE assigned programs at the laboratory."

Value/Funding The value of, and funding for the National Laboratory Contractor will be performed under the laboratory's M&O contract. A work authorization will be issued in accordance with standard practices.

- **Federally Funded Research and Development Center (FFRDC) Contractors**

FFRDC contractors, whether DOE's or another agency's, may be proposed as team members on another entity's application, subject to the following guidelines:

Authorization for non-DOE FFRDCs The Federal agency sponsoring the non-DOE FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of an FFRDC contractor must be consistent with the contractor's authority under its award.

Authorization for DOE FFRDCs The cognizant contracting officer for the DOE FFRDC must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. See above for acceptable authorization language.

Value/Funding The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant. Usually, DOE will fund a DOE FFRDC contractor through the DOE field work proposal system. Non-DOE FFRDC contractors will be funded through an interagency agreement with the sponsoring agency.

Responsibility The prime applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

PART IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE

- Application forms and instructions are available at Grants.gov. To access these materials, go to <http://www.grants.gov>, select “Apply for Grants,” and then select “Download Application Package.” Enter the CFDA and/or the funding opportunity number located on the cover of this announcement and then follow the prompts to download the application package.

B. LETTER OF INTENT AND PRE-APPLICATION

- **Letter of Intent.** Letters of intent are not required.
- **Pre-Applications.** Pre-applications are required. A separate pre-application must be submitted for each program element under Part I, for which the applicant is interested in receiving an award. You must complete the SF 424 R&R, attach your pre-application file in the block provided, and submit electronically to AFCRandD@id.doe.gov.

Pre-application file. Submission of the Pre-application is MANDATORY to be considered for award. Required Pre-applications must be submitted by the date and time specified in Part IV, Paragraph E.1. Applicants who do not submit a Pre-application are ineligible to receive an award under this FOA. No FAX or mail submission of Pre-applications will be accepted.

Submit your Pre-application to AFCRandD@id.doe.gov. Acknowledgement of receipt of the Pre-application will be provided to all preapplicants within three to five (3-5) work days of the date set for receipt of Pre-applications. If you receive no such acknowledgement, contact DOE by sending an email to surrujsk@id.doe.gov.

The Pre-application file must be no longer than two (2) pages in length when printed using standard 8.5" X 11" paper with 1 inch margins (top, bottom, left, right), using a font size not smaller than Arial 11 point. The following minimum information must be included:

-Title of Project

-A summary of the proposed project, including a description of the project and a clear explanation of its importance and relevance to the objectives covered by this FOA.

-Name of Project Director/Principal Investigator(s) and associated organization

-The name of the potential recipient and any other potential major subrecipients (i.e., subrecipients doing 20% or more of the work, or doing less than 20% but accomplishing a task(s) of key importance)

DOE will review Pre-applications for acceptability considering relevance to program objectives presented and suitability in the technical areas specified in this FOA. Based on this review, DOE will provide advice to applicants as to whether or not the applicant may continue in the competitive FOA process, as follows:

-Pre-application Acceptance. The Pre-application is accepted; the applicant is encouraged to prepare/submit a formal application in accordance with Part IV.C. of this FOA for evaluation and award consideration. Based on the review of the Pre-application package, DOE may provide feedback to the applicant as to areas of the proposed project that can/will be removed or modified. Acceptance of a Pre-application does not guarantee that the applicant will be selected for award.

-Pre-application Rejection. The Pre-application is rejected; the applicant is discouraged from proceeding to submit an application for further award consideration, although any timely application that is submitted will be evaluated for award. Upon request, the DOE may provide the general basis why the project is not considered viable for award.

C. CONTENT AND FORM OF APPLICATION – 424 (R&R)

You must complete the mandatory forms and any applicable optional forms (e.g., Disclosure of Lobbying Activities (SF-LLL)) in accordance with the instructions on the forms and the additional instructions below. Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this announcement.

1. SF 424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. To activate the instructions, turn on the “Help Mode” (Icon with the pointer and question mark at the top of the form). The list of certifications and assurances referenced in Field 18 can be found on the DOE Financial Assistance Forms Page at http://management.energy.gov/business_doe/business_forms.htm under Certification and Assurances.

2. Other Project Information

Complete questions 1 through 5 and attach files. The files must comply with the following instructions:

Project Summary/Abstract (Field 6 on the Form)

The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It will be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public. The project summary must not exceed 1 page when printed using standard 8.5” by 11” paper with 1” margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click “Add Attachment.”

Project Narrative (Field 7 on the Form)

The project narrative must not exceed 10 pages, including cover page, table of contents, charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5” by 11” paper with 1 inch margins (top, bottom, left, and right). **EVALUATORS WILL ONLY REVIEW THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE.** The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application, because the information contained in these sites will not be reviewed. See Part VIII.D for instructions on how to mark proprietary application information. To attach a Project Narrative, click “Add Attachment.”

The project narrative must include:

- Project Objectives: This section will provide a clear, concise statement of the specific objectives/aims of the proposed project.
- Merit Review Criterion Discussion: The section will be formatted to address each of the merit review criterion and sub-criterion listed in Part V.A. Provide sufficient information so that reviewers will be able to evaluate the application in accordance

with these merit review criteria. DOE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERION AND SUB-CRITERION.

- Relevance and Outcomes/Impacts: This section will explain the relevance of the effort to the objectives in the program announcement and the expected outcomes and/or impacts.
- Roles Of Participants: For multi-organizational or multi-investigator projects, describe the roles and the work to be performed by each participant/investigator, business agreements between the applicant and participants, and how the various efforts will be integrated and managed.
- Multiple Principal Investigators: The applicant, whether a single organization or team/partnership/consortium, must indicate if the project will include multiple PIs. While the Department of Energy's preference is to have only one PI specified, this decision is solely the responsibility of the applicant; having multiple PIs specified will not affect the selection for award of applications submitted in response to this Funding Opportunity Announcement.

If multiple PIs will be designated, the application must identify the Contact PI/Project Coordinator and provide a "Coordination and Management Plan" that describes the organization structure of the project as it pertains to the designation of multiple PIs. This plan will, at a minimum, include:

- process for making decisions on scientific/technical direction;
 - publications;
 - intellectual property issues;
 - communication plans;
 - procedures for resolving conflicts; and
 - PIs' roles and administrative, technical, and scientific responsibilities for the project.
- Facilities And Other Resources: Identify the facilities (e.g., office, laboratory, computer, etc.) to be used at each performance site listed and, if appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Provide any information describing the other resources available to the project such as machine and electronics shops.
- Equipment: List important items of equipment already available for this project and, if appropriate, note the location and pertinent capabilities of each. If you are proposing to acquire equipment, describe comparable equipment, if any, already at your organization and explain why it cannot be used.
- Biographical Sketch Appendix:
Provide a biographical sketch for the project director/principal investigator (PD/PI) and each senior/key person listed in Section A on the R&R Budget form. Provide the biographical sketch information as an appendix to your project narrative. Do not attach a separate file. The biographical sketch appendix will not count in the project narrative page limitation. The biographical information for each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include:

Education and Training:

Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree, and year.

Research and Professional Experience:

Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications:

Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically.

Patents, copyrights, and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities: List no more than 5 professional and scholarly activities related to the effort proposed.

- Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers Appendix:

Provide the following information in this section. This appendix will not count in the project narrative page limitation:

Collaborators and Co-editors: List in alphabetical order all persons, including their current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this application. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this application. If there are no collaborators or co-editors to report, state "None."

Graduate and Postdoctoral Advisors and Advisees: List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s) during the last 5 years. Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates.

Other Attachments (Field 11 on the form):

If you need to elaborate on your responses to questions 1-5 on the "Other Project Information" document, attach a file in Field 11.

Budget for DOE National Laboratory or Federally Funded Research and Development Center (FFRDC) Contractor, if applicable. If a DOE National Laboratory Contractor or an FFRDC contractor is to perform a portion of the work, you must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1 Work Authorization System. This order and the DOE Field Work Proposal form are available at http://management.energy.gov/business_doe/business_forms.htm. Use the Contractor or FFRDC name as the file name (up to 10 letters) and attach to the R&R Other Project Information form in Field 11 – Add Attachments.

Environmental Questionnaire

You must complete the environmental questionnaire at <http://www.id.doe.gov/PSD/FAFormsGuidance.html>. Save the questionnaire in a single file named "Env.pdf" and click on "Add Attachments" in Field 11 to attach.

3. RESEARCH AND RELATED BUDGET (TOTAL FED + NON-FED)

Complete the Research and Related Budget (Total Fed & Non-Fed) form in accordance with the instructions on the form (Activate Help Mode to see instructions) and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (See PART IV.G.).

Budget Justification (Field K on the form).

Provide the required supporting information for the following costs (See R&R instructions): equipment; domestic and foreign travel; participant/trainees; material and supplies; publication; consultant services; ADP/computer services; subaward/consortium/contractual; equipment or facility rental/user fees; alterations and renovations; and indirect cost type. Provide any other information you wish to submit to justify your budget request. Attach a single budget justification file for the entire project period in Field K. The file automatically carries over to each budget year.

4. R&R SUBAWARD (Total Fed + Non-Fed) FORM

Budgets for Subawardees, other than DOE National Laboratory and FFRDC Contractors. You must provide a separate cumulative R&R budget for each subawardee that is expected to perform work estimated to be more than \$100,000 or 50 percent of the total work effort (whichever is less). Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET (Total Fed + Non-Fed) FORM and e-mail it to each subawardee that is required to submit a separate budget. After the Subawardee has e-mailed its completed budget back to you, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee's name as the file name.

5. Disclosure of Lobbying Activities (SF-LLL)

If applicable, complete SF- LLL. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH AND RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 6
Project Narrative, including required	PDF	Field 7

appendices		
Budget for DOE National Laboratory Contractor or FFRDC, if applicable	PDF	Field 11
Environmental Questionnaire	PDF	Field 11
RESEARCH AND RELATED BUDGET (Total Fed + Non-Fed)	Form	N/A
Budget Justification	PDF	Field K
R&R SUBAWARD BUDGET (Total Fed + Non-Fed) ATTACHMENT(S) FORM , if applicable	Form	N/A
SF-LLL Disclosure of Lobbying Activities , if applicable	Form	N/A

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable

E. SUBMISSION DATES AND TIMES

1. Pre-application Due Date

- Pre-applications must be received by 05/08/2008, not later than 8:00 PM Eastern Time.

2. Application Due Date

- Applications must be received by 06/10/2008, not later than 8:00 PM Eastern Time. You are encouraged to transmit your application well before the deadline. APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.

F. INTERGOVERNMENTAL REVIEW

- This program is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

G. FUNDING RESTRICTIONS

Cost Principles: Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. The cost principles for commercial organization are in FAR Part 31.

Pre-award Costs: Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. Where to Submit

- **APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV TO BE CONSIDERED FOR AWARD.** Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@grants.gov.

2. Registration Process

- You must COMPLETE the one-time registration process (all steps) before you can submit your first application through Grants.gov (See www.grants.gov/GetStarted). **We recommend that you start this process at least three weeks before the application due date.** It may take 21 days or more to complete the entire process. Use the Grants.gov Organizational Registration Checklists at <http://www.grants.gov/assets/OrganizationRegCheck.pdf> to guide you through the process. **IMPORTANT:** During the CCR registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called "Marketing Partner identification Number" (MPIN). When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e., Grants.gov registration).

3. Application Receipt Notices

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of five e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to two (2) business days from application submission to receipt of email Number 2. When the AOR receives email Number 5, it is their responsibility to follow the instructions in the email to logon to IIPS and verify that their application was received by DOE. You will need the Submission Receipt Number (email Number 1) to track a submission. The titles of the five e-mails are:

Number 1 - Grants.gov Submission Receipt Number
Number 2 - Grants.gov Submission Validation Receipt for Application Number
Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number
Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number
Number 5 - DOE e-Center Grant Application Received

The last email will contain instructions for the AOR to register with the DOE e-Center. If the AOR is already registered with the DOE e-Center, the title of the last email changes to:

Number 5 - DOE e-Center Grant Application Received and Matched

This email will contain the direct link to the application in IIPS. The AOR will need to enter their DOE e-Center user id and password to access the application.

PART V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

- Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for an award; (2) the information required by the announcement has been submitted; (3) all mandatory requirements are satisfied; and (4) the proposed project is responsive to the objectives of the Funding Opportunity Announcement.

2. Merit Review Criteria

1. Technical Merit of the Proposed Work (40%): The technical section of the application will clearly define what research is being performed and its relationship to the relevant program element(s). This criterion will consider the technical merit of the application including proposed technical objectives and deliverables and the likelihood of achieving them, and the potential contribution to the state of knowledge in the relevant program element(s).
2. Appropriateness of the Proposed Method or Approach (25%): This criterion will consider the technical approach, project management including the approach for integrating all personnel and resources, and the potential enhancement of U.S. infrastructure, such as trained personnel resources, new technologies, facilities or equipment, for the relevant program element(s).
3. Competency of the Proposed Team (25%): This criterion will consider the qualification and experience of the Principle Investigator and applicant's personnel and adequacy of proposed resources including facilities applied by the participating organization.
4. Schedule and Resources (10%): The applicant's schedule (list of tasks, task sequencing, milestones, decision points and estimated durations) is reasonable and appropriate. The planned resources proposed, including assignment of responsibilities and manpower levels, are adequate/appropriate to accomplish the proposed task and Statement of Objectives.

Note that merit review team members are selected with regard to both their technical expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of an application constitutes agreement that this is acceptable to the applicant, sub-applicants(s) and the submitting institutions.

3. Other Selection Factors

The selection official may consider the following program policy factors in the selection process:

1. Technical diversity of projects; applications will be balanced to optimize the selection of the appropriate mix of applications to best achieve the AFCI objectives.
2. Relevance to agency's programmatic needs.
3. Cost/Budget considerations, including any cost sharing proposed by the applicant.

Any of the above factors used will be independently considered by the Selection Official in determining the optimum mix of applications that will be selected for support.

B. REVIEW AND SELECTION PROCESS

1. Merit Review

- Applications that pass the initial review will be subjected to a merit review in accordance with the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance and Unsolicited Proposals." This guide is available under Financial Assistance, Regulations and Guidance at <http://www.management.energy.gov/documents/meritrev.pdf>.

2. Selection

- The Selection Official will consider the merit review recommendation, program policy factors, and the amount of funds available.

3. Discussions and Award

- The Government may enter into discussions with a selected applicant for any reason deemed necessary, including but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR part 600; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

- DOE is striving to make selections within six to eight months after receipt of applications.

PART VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

- DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Part IV.G. with respect to the allowability of pre-award costs.)

Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award

- A Notice of Financial Assistance Award issued by the contracting officer is the authorizing award document. It normally includes either as an attachment or by reference: (1) Special Terms and Conditions; (2) Applicable program regulations, if any; (3) Application as approved by DOE.; (4) DOE assistance regulations at 10 CFR part 600, or, for Federal Demonstration Partnership (FDP) institutions, the FDP terms and conditions; (5) National Policy Assurances To Be Incorporated As Award Terms; (6) Budget Summary; and (7) Federal Assistance Reporting Checklist, which identifies the reporting requirements.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR part 600 (See: <http://ecfr.gpoaccess.gov>), except for grants and cooperative agreements made to Federal Demonstration Partnership (FDP) institutions. The FDP terms and conditions and DOE FDP agency specific terms and conditions are located on the National Science Foundation web site at http://www.nsf.gov/awards/managing/fed_dem_part.jsp.

2. Special Terms and Conditions and National Policy Requirements

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at http://management.energy.gov/business_doe/business_forms.htm. The National Policy Assurances to Be Incorporated as Award Terms are located at DOE http://management.energy.gov/business_doe/business_forms.htm.

3. Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://www.gc.energy.gov/financial_assistance_awards.htm.

C. REPORTING

- Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached.

PART VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions regarding the content of the announcement must be submitted through the DOE's e-Center at www.e-Center.gov. You must register with e-Center to submit questions. DOE will try to respond to a question within 3 business days.

Questions relating to the registration process at Grants.gov, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. DOE cannot answer these questions.

B. AGENCY CONTACT

Name: Janet K. Surrusco
E-mail: surrusjk@id.doe.gov

* However, follow procedure at Part VII.A. for questions regarding this FOA.

PART VIII - OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this announcement will be posted on Grants.gov and the DOE Industry Interactive Procurement System (IIPS). You can receive an email when a modification or an announcement message is posted by joining the mailing list for this announcement through the link in IIPS. When you download the application at Grants.gov, you can also register to receive notifications of changes through Grants.gov.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. PROPRIETARY APPLICATION INFORMATION

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, will be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the application which are to be restricted:

"The data contained in pages _____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit

organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See “Notice of Right to Request Patent Waiver” in paragraph G below.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE’s own needs or to insure the commercialization of technology developed under a DOE agreement.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

ATTACHMENTS

- A. REPORTING REQUIREMENTS CHECKLIST**
- B. AWARDEE POINT OF CONTACT DATA INPUT SHEET**